

Monthly Fog Frequency in the Continental United States

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ABSTRACT—The heavy fog statistics for 244 first-order weather stations were used to generate experimental objective analyses of the annual and monthly geographic distribution of heavy fog within the Continental United States. The resulting computer-prepared map of annual

distribution was compared with existing analyses and was found to be in reasonable agreement. The maps of monthly distribution of fog are presented as a new contribution for use in forecasting and other operations.

1. INTRODUCTION

The aviation community and the general public continually demand more accurate local weather forecasts. Current meteorological problems associated with forecast improvement are not limited just to scientific and technological areas but include operating procedures and data availability for the local forecaster.

With regard to the problem of data availability within the field of fog climatology, Peace (1969) provided a current and detailed analysis of the annual frequency of heavy fog in the Continental United States and a good synopsis of the literature then available in the field. However, a survey of the literature through 1971 revealed only one study (George 1958) in which monthly fog distribution was investigated. George confined his study

UNITED STATES DISTRIBUTION OF FOG ANNUAL

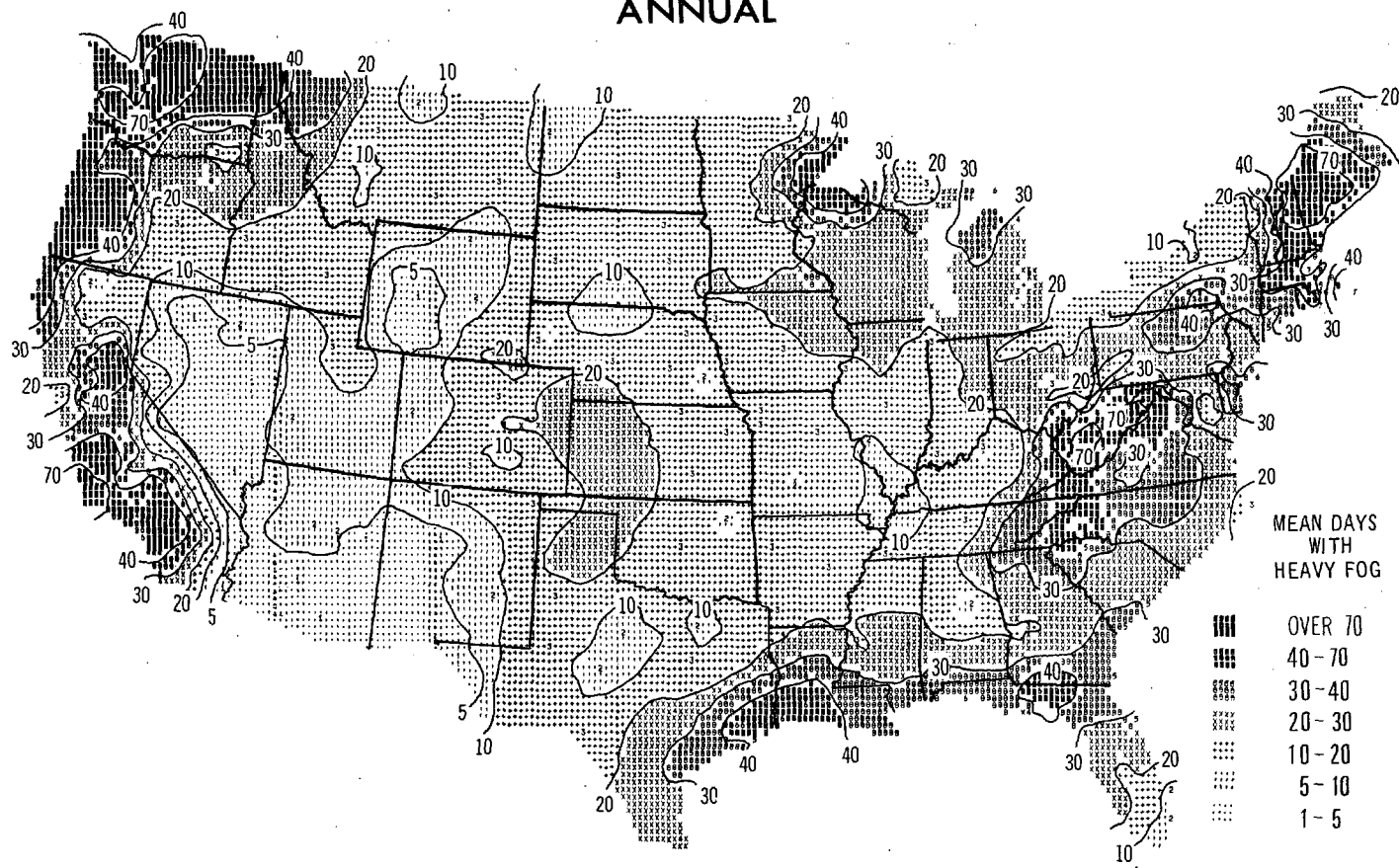


FIGURE 1.—Annual distribution of the mean number of days with heavy fog (from Environmental Data Service, NOAA, 1971).

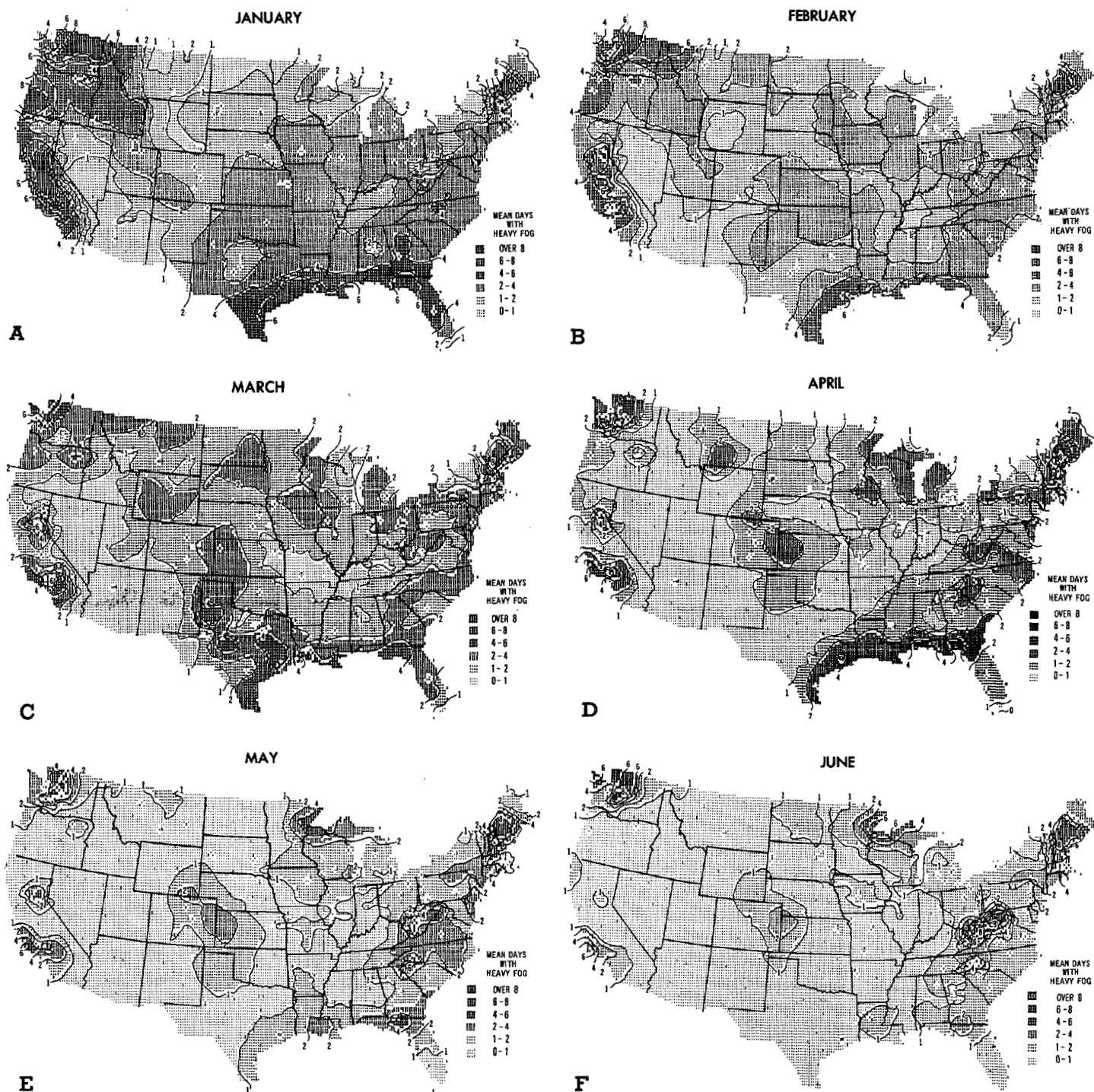


FIGURE 2.—Distribution of the mean number of days with heavy fog in (A) January, (B) February, (C) March, (D) April, (E) May, and (F) June.

to the eastern half of the United States, east of longitude 105° W. In that report, however, he emphasized the value of using fog climatology to improve the accuracy of fog prediction. The indicated need for and current lack of monthly climatological maps of fog distribution motivated the development of the maps offered herein.

Data for this set of objectively analyzed maps were taken from the Environmental Data Service, NOAA, *Local Climatological Data* annual summaries for 244 first-order weather stations in the Continental United States for 1970. The data utilized were the mean annual number

of days with heavy fog (defined as restricting visibility to $\frac{1}{4}$ mi or less) and the mean monthly number of days with heavy fog as reported in the annual summaries for 1970. The statistics used in computing the individual monthly and annual means are based on the total length of record at each station and so represent different numbers of years of observations.

2. ANALYSIS

Fog has long been considered a local meteorological phenomenon because of its relationship to local terrain

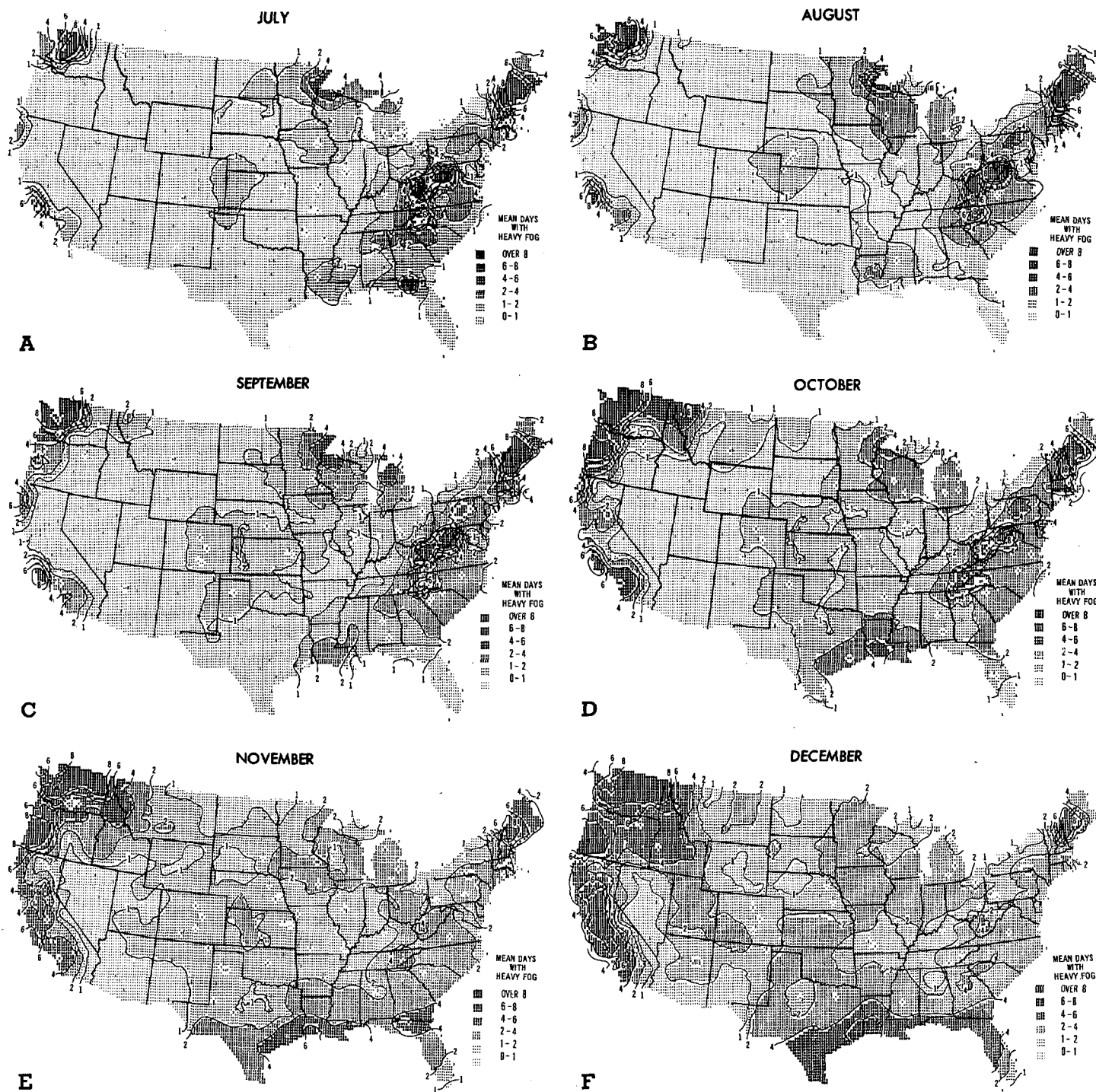


FIGURE 3.—Distribution of the mean number of days with heavy fog in (A) July, (B) August, (C) September, (D) October, (E) November, and (F) December.

and geography. Peace furnished a current analysis of annual fog frequency distribution in the United States in which the isopleths were drawn as objectively as possible to the data from some 256 first-order weather stations. To achieve an absolutely objective analysis, we used the SYMAP computer program developed by Harvard University and available at the University of Kansas to produce the maps of the annual and monthly distribution of heavy fog offered herein. Figure 1 is the computer interpretation of the *annual* mean number of days with heavy fog in the Continental United States.

This map shows striking similarities to the distribution map produced by Peace. These similarities verify the objective interpretation claimed by Peace and indicate that the computer interpretation of *monthly* data should provide a sound and reliable representation of the geographical distribution of heavy fog in the Continental United States.

The fog statistics, on the whole, show a smooth, continuous distribution. The two primary exceptions are the mountain areas around Mt. Washington, N. H., and Stampede Pass, Wash., which have records of ex-

tremely high fog frequencies. Data from these stations caused Peace to draw very steep isopleth gradients. Since the computer could not "draw" such steep gradients, its analysis was greatly biased by these data, so relatively large geographic areas with high fog frequencies are shown within the New England and Washington State regions.

The mean monthly data also were analyzed by use of the SYMAP program to produce maps of the distribution of heavy fog in the Continental United States for each month of the year (figs 2, 3). The monthly fog frequency data were divided into six classes: 0 to 1, 1 to 2, 2 to 4, 4 to 6, 6 to 8, and over 8 mean days with heavy fog during a calendar month. The annual fog statistics were grouped into seven classes (fig. 1).

In the classical study of fog distribution by Stone (1936), a good description of the occurrence of fog by season was provided for each of his designated fog regions. The current monthly maps offered here (figs. 2, 3), together with Stone's qualitative seasonal descriptions provide a sound combination for analyzing the monthly geographical distribution of heavy fog.

3. CONCLUSION

These monthly maps of fog frequency distribution within the Continental United States can be used by the forecaster to avoid predicting fog in an area where history

indicates that none has occurred during that month of the year. In addition to use in forecasting, there are a multitude of uses within the general field of planning where the significance of fog occurrence as an operational hazard becomes critical. It is hoped that the maps offered here will help to fill the existing need for monthly fog distribution maps of the Continental United States.

ACKNOWLEDGMENTS

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